

## **Congressional Notification Profile**

***DE-PS26-02NT41369***

UNIVERSITY COAL RESEARCH PROGRAM, CORE PROGRAM

Texas A&M University

### **Background and Technical Information:**

**Project Title:** "Development of All Solid-State Sensors for Measurement of Nitric Oxide and Ammonia Concentrations by Optical Absorption of Particle-Laden Combustion Exhaust Streams."

Texas A&M University proposes to further develop and demonstrate new optical sensors to better measure nitric oxide, which is subject to tighter emissions regulations, and ammonia emitted from coal-fired boilers and gas turbines. Sensors will be tested in a simulated combustion exhaust environment and an actual exhaust stream at the university's coal/biomass burner facility.

### **Contact Information:**

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Congressional District: TX 8<sup>th</sup>

County: Brazos

### **Financial Information:**

Length of Contract (months): 12

Government Share: \$199,284

Total value of contract: \$199,284

### **DOE Funding Breakdown:**

Funds: FY 2002 \$199,284

## **PROJECT ABSTRACT**

### **DEVELOPMENT OF ALL-SOLID-STATE SENSORS FOR MEASUREMENT OF NITRIC OXIDE AND AMMONIA CONCENTRATIONS BY OPTICAL ABSORPTION IN PARTICLE-LADEN COMBUSTION EXHAUST STREAMS**

The development and demonstration of new optical sensors for the measurement of nitric oxide (NO) and ammonia (NH<sub>3</sub>) by optical absorption in combustion exhaust streams is proposed. The development of these diode-laser-based systems will enhance significantly pollutant emission sensor capabilities for practical combustion devices including coal boilers and power-generating gas turbines. Nitric oxide (NO) is of course a key pollutant species and is subject to increasingly stringent emission regulations. Ammonia injection into combustion exhaust streams is used to reduce NO<sub>x</sub> levels; this is the thermal deNO<sub>x</sub> process.

The diode-laser-based optical sensor for NO is based on sum-frequency-mixing (SFM) of the output of a 532-nm, intracavity frequency-doubled, diode-pumped Nd:YAG laser and a 395-nm external cavity diode laser (ECDL). We have recently developed this sensor system and have performed an initial set of absorption measurements of NO in a room-temperature, variable-pressure gas cell. A major objective of the proposed research program is to characterize the performance and optimize the sensor system for measurements of NO in hot, particle-laden combustion exhaust. The rapid tuning of the sensor wavelength over the absorption features of NO should help to minimize significantly interferences due to broadband absorption or particle scattering.

A second major objective of the proposal is to develop a mid-infrared absorption sensor for ammonia based on difference-frequency-mixing (DFM) of the laser radiation from a 1064-nm diode-pumped Nd:YAG laser and a 785-nm ECDL. The DFM process will occur in a periodically poled lithium niobate (PPLN) crystal to produce mid-infrared laser radiation at 3.00  $\mu\text{m}$  to access strong fundamental absorption bands of NH<sub>3</sub>.

The NO and NH<sub>3</sub> sensors will be tested in both simulated combustion exhaust and in the particle-laden exhaust stream from a coal/biomass burner facility at Texas A&M University.

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